arroyo instruments

APPLICATION NOTE AN-020

Building a Complete System for QCL HHL Lasers

April 2, 2021, Rev A

Operation of QCL lasers is very dependent both a stable, low-noise current source for the laser plus the ability to control the temperature of the laser chip across a wide range, as temperature, combined with current, determines the operating frequency of the QCL laser. Thermal control can often be one of the more challenging aspects of the system due to the wide temperature range required of the QCL laser.

This document will provide suggestions for both control of the laser as well as thermal solutions to manage the wide temperature requirements.

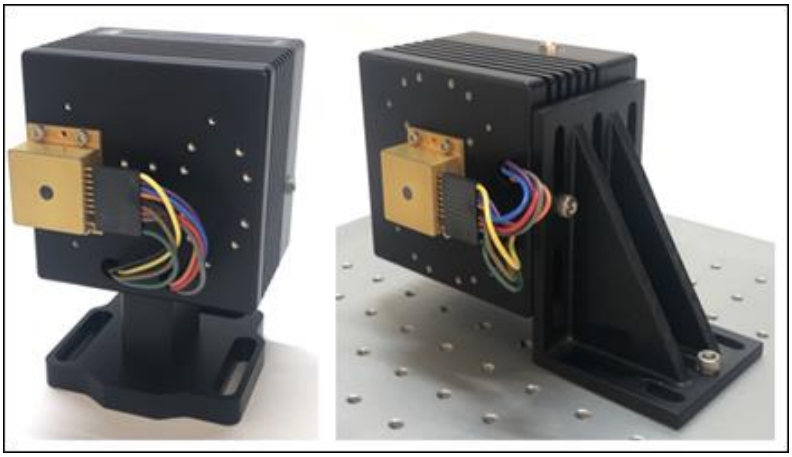
Controlling the QCL Laser and TEC

HHL laser modules have a need for both driving the QCL laser itself plus control of the internal thermoelectric cooler (TEC) module for temperature stabilization. With a 1 Amp / 18 Volt output for the laser, the 6310-QCL will provide the current and voltage requirements for most QCL lasers. The integrated 60W temperature controller has enough power to most QCL TEC modules. The 6310-QCL is also a very low-noise controller, with less than 2.5uA RMS of current noise on the laser and better than 0.002°C temperature stability. High current and voltage options are available, contact the factory for more details.

As for temperature control, Arroyo Instruments offers three different configurations that go from most cost effective to highest performance. Choosing the right solution will ensure the QCL laser can reach the full requirements of your application.

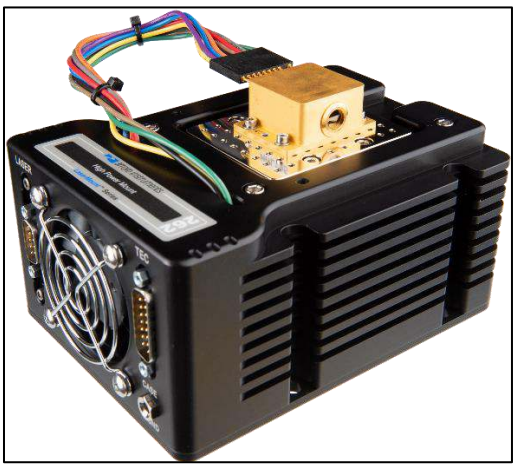
Lowest-Cost Solution

The **244 LaserMount** is our solution for typical HHL applications. It has the laser and TEC connectors integrated, comes with a pedestal-type mounting which can be removed for alternative mounting methods (such as the 30-60-90 bracket [not included with the mount] shown in the right photo). The device can be rotated 90° so the pedestal mount can be used, but the bracket allows for more flexible adjustment of beam height relative to the table. The device can be both center and edge mounted onto the face of the 244. As it is a passive system, there is no need for a second TEC controller.



Highest Passive Performance

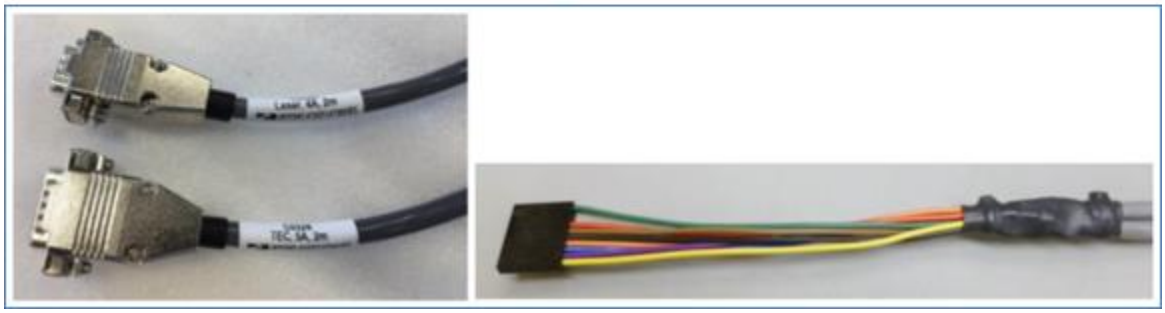
The 262-06-06-DB9 LaserMount is based on our **262 LaserMount**. It adds a copper heat spreader and HHL wiring harness for plug-and-play operation. This should generally support laser temperature operation down to 0°C or lower for most QCL devices, although a review of the total heat load of the QCL should be considered. Like the solution above, it is a passive system so there is no need for a second TEC controller.



Lowest Operating Temperature

The **285 TECMount** is a higher performance air-cooled mount that will support up to 50W at a 25°C plate temperature and should be enough to allow -30°C laser temperature operation. It does require its own temperature controller, typically a **5310 TECSource** (although the lower cost **5305** might work in a lower power application).

Another mount option would be the **274 TECMount**. This is a water-cooled mount, and for customers that already have house water, would be an interesting option. Because of the heat-shedding performance of water, a smaller temperature controller can be used for external temperature control. Unlike the **244** and **262** mounts, the **285** and **274** mounts do not have an integrated HHL wire harness, and instead requires a separate cable harness (see cable photo below).



In Summary

Below is a chart that quickly summarizes the various options for the thermal platform. When combined with a 6310-QCL ComboSource controller, it creates a complete plug-and-play system.

Solution	Est. Lowest Laser Temp	Mount	Benchtop Case TEC Controller	Case Control	HHL Cable(s)	Case TEC Cable
Lowest Cost	10°C	244	None	Passive	1220B and 1260B	n/a
Best Passive Performance	0°C	262	None	Passive	1220B and 1260B	n/a
Lowest Temperature, Air	-30°C	285	5305 or 5310	TEC / Air	C0326	1260B or 1262B
Lowest Temperature, Water	-30°C	274	5240 or 5305	TEC / Water	C0326	1260B

Please contact the factory for any questions you might have on the various solutions available, or to explore other options that might fit your requirements better.